

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)	
)	
Amendment of Part 97 of the Commission's)	RM-11306
Rules Governing the Amateur Radio Service)	
Concerning Permitted Emissions and)	
Control Requirements)	

To: The Chief, Wireless Telecommunications Bureau
Via Office of the Secretary
Federal Communications Commission

COMMENTS

DATE: February 6, 2006

Michael J. Keane, licensee of Amateur Station K1MK, representing himself, hereby respectfully submits these Comments on the Petition for Rule Making ("the Petition") filed in the above-captioned proceeding on or about 14 November, 2005 by ARRL, the National Association For Amateur Radio. Mr. Keane is an Amateur Extra class licensed amateur radio operator and has been a licensed amateur radio operator since 1969. He is also a life member of the ARRL, the Petitioner in this matter.

Having reviewed the Petition, and while I do find the Petition has some merit and I support its purpose, I cannot endorse most of the specific rules changes that the Petition proposes.

I. Removing Limitations on Symbol Rate

1. The Petition states:

This double-regulation (limitation to specified emissions with specific bandwidth maxima, and limitation of those emissions to specific symbol-rate limits) has undoubtedly handicapped Amateur digital data communication development and use. It is now necessary to permit higher data rates, in order to permit the development of digital multimedia technology, which is now coming into use in the Amateur Radio Service, and which has great promise for improving and fostering more effective emergency and disaster relief communications.¹

The clear implication here being that elimination of the current limits on symbol rate is one of the changes that are necessary to permit higher speed data in the Amateur band. However, at least as far as digital data communications on the Amateur bands from 1.8 MHz to 29.7 MHz are concerned, that is an unproven assertion that flies in the face of technical facts and practical experience. *The proposed elimination of the symbol rate limits does very little to permit higher data rates at HF².*

2. Allowing symbols rates in excess of those currently authorized at VHF and UHF (19.6 kilobauds at 6 m & 2 m and 56 kilobauds at 1.25 m & 70 cm) is a technically valid approach response for permitting development of higher data rate emissions in those bands. However, at HF where the effects of fading and multi-path propagation are the dominant forms of channel errors, it is the authorized

¹ The Petition at paragraph 8.

² The Petition at paragraph 10 cites the example of a recent inquiry about “a new mode with a symbol rate of nearly 5600 baud and a bandwidth of 2.4 kHz.” While this inquiry may well have been sincerely motivated and may accurately reflect a genuine interest in high data rates amongst Amateurs, a mode with the parameters cited would not be realizable as those parameters contradict the results of Nyquist’s theorem. In addition to the bandwidth and symbol rates limits specified in the Commissions rules, modes must also comply with an even higher authority.

bandwidth and not the symbol rate that is the determining factor for the data rate that can be achieved most of the time. A higher symbol rate is most often counter-productive at HF. Increasing the symbol rate does not necessarily yield a proportional increase in the data rate over channels which experience fading.

3. Focusing specifically on HF, the engineering reality is that inter-symbol interference (ISI) arising from multi-path propagation renders the use of very high symbol rates impractical even under the most favorable conditions. For the 2 - 5 ms multi-path delay spreads that are typically encountered at HF, symbol rates substantially less than 300 baud often suffer significant degradation due to ISI resulting from multi-path effects. The maximum authorized symbol rate of 300 baud can only be successfully employed at HF for brief periods during exceptional conditions. Higher symbol rates are of little or no practical benefit in achieving the higher data in the HF region of the spectrum³.

4. Alternatively, approaches which signal at a low symbol rate but densely encode large number of bits into each symbol are routinely used to deliver higher data rates at HF, even under adverse conditions. The compression of a large number of bits into one symbol can be achieved via several approaches: m-ary FSK, multi-tone keying, orthogonal frequency domain multiplexing (OFDM), *etc.* Current regulations, with their restrictions on symbol rate, have not prevented Amateurs from experimentation, evaluation and utilization of such advanced digital

modulation techniques as a practical means of implement wider bandwidth, faster digital communications on the air at HF⁴. *The Petition fails to provide a single example of the existing rules having frustrated such efforts.*

5. No authorized bandwidth limits are enumerated in the current Part 97 for RTTY and data mode emissions at frequencies less than 50 MHz, except for stations operating under automatic control⁵. Indeed, the Petition proposes to impose bandwidth limits for the first time on RTTY and data mode emissions from stations operating at HF under local control. As the ultimate effect of setting a maximum bandwidth is to limit the maximum data rates that can be achieved, this change is contrary to the Petition's stated goal of permitting higher data rates. The proposed rule changes do relax bandwidth restrictions on automatically controlled stations operating outside the segments designated in §97.221(b) and thereby do permit higher data rates for these particular stations. However, this bit of deregulation is accomplished by introducing bandwidth limits that place a regulatory cap on the data rates that could be achieved by the majority of Amateur stations at HF which operate under local control, not automatic control. With restrictions on symbol rate

³ It is true that using a very high symbol rate with a symbol period less than minimum multi-path delay is an alternative approach for dealing with ISI. This approach requires symbol rates that are not consistent with the 3500 Hz maximum bandwidth that has been proposed in the Petition..

⁴ The Petition at paragraph 9 states:

“Digital voice is also accommodated under the definition of Phone in §97.3(c)(5)...”

If digital voice is accommodated as J2E as described in the reference cited by the ARRL in footnote 9 of the Petition, then similar emission types which permit a high data rate at a low symbol rate must logically also be accommodated as J2D and J2B under the definitions of Data and RTTY in §97.3(c)(4) and §97.3(c)(7) respectively.

⁵ Transmissions of automatically controlled “digital” stations are restricted to 500 Hz under certain conditions, see §97.221.

but not bandwidth, it is the natural limits set by propagation conditions and not the artificial limits imposed by regulation that must be overcome in order to increase data rates.

6. Turning to the possible consequences that might result from removing the restrictions on symbol rate, such a change does not appear to pose a credible threat of increased interference. While some Amateurs might engage in experiments or limited over-the-air trials aimed at achieving higher data rates by means of higher symbol rates, in the end, Nature would not be fooled. One would not expect the interest in approaches that prove less functional than the alternatives to be sustained for very long. Ultimately Amateurs can be expected to vote with their feet and with their time, migrating to technological solutions that work. As higher symbol rates are ineffectual and will not be used, eliminating the symbol rate limits poses a negligible threat for causing increased interference.

7. Thus, while eliminating symbol rate restrictions would not be expected to have any significant positive effect on facilitating development of practical Amateur digital data communications or advancing the state of radio art, neither does their elimination pose any serious risk of disruption to the status quo. Therefore, even though it appears to be an unnecessary change and one lacking any technical justification, I do not oppose the elimination of the restrictions on symbol rate for RTTY and data emissions currently specified in §97.307(f)(3) and §97.307(f)(4).

II. Enabling Multimedia Development

8. A reason cited in the Petition for moving to segmentation by bandwidth rather than by mode is the natural and inevitable blurring of distinctions between data, phone and image mode when these are transmitted by digital methods.⁶ Concern over restricting development of multimedia might be a valid reason for concern if such development could not be accommodated under the existing rules. *However, the existing rules can readily accommodate multimedia with minor changes.*

9. In addition to the symbol rate limits in §97.307(f), the only other restriction placed upon RTTY& data mode emissions at HF is for the specific case of frequency-shift keying, where there is a limit of 1 kHz shift between mark and space⁷. All emissions, including RTTY and data, must satisfy the requirement of §97.307(a) to “not occupy more bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice.” *The Petition fails to explain how such liberal rules have handicapped Amateur digital data communication development and use.*

10. As digital voice, digital imagery and data all may be sent using symbol rates less than the 300 baud limit imposed on the data mode at HF, a multimedia

⁶ The Petition at paragraph 10.

⁷ Note that §97.307(f)(3) reads in part: “The symbol rate must not exceed 300 bauds, *or for frequency-shift keying*, the frequency shift between mark and space must not exceed 1 kHz” (emphasis added). By the choice of “or” rather than “and,” the plain language of this rule suggests that the limitation to 300 bauds is not to be applied to frequency-shift keying. This is in contrast to the relevant portion of §97.307(f)(4): “The symbol rate must not exceed 1200 bauds. For frequency-shift keying, the

combination of the three can be accommodated in the current data mode segments without even having to eliminate the existing baud rate limits. So what is hindering development of digital multimedia applications? It is the Amateur Service's continued reliance on a content-based interpretation of the rules, a paradigm that may be best summarized as: "Not everything that is 'digital' is automatically 'Data.'⁸" Now is an opportune moment to reexamine this approach to interpreting the rules.

11. The historical rationale for keeping digital voice and digital image transfer in the phone segments was that these emissions have been "wideband" emissions *i.e.*, having the bandwidth of a communications quality phone emission. Concerns in regards to symbol rate limitations should digital voice and digital image be classified as data emission type are unfounded⁹, arising perhaps in confusion between data rate and symbol rate. Now, as data emissions evolve towards being wideband emissions, we face a choice: should wideband (high-speed) RTTY and data emissions be allowed to move upward into what are now the phone & image segments; or should digital emissions be allowed to move downward to share specific RTTY and data segments designated for wideband emissions. I suggest the latter is the preferable option. The continued retention of segmentation by mode would therefore remain necessary in order to maintain the distinctions between disparate modes having similar bandwidths.

frequency shift between mark and space must not exceed 1 kHz" having a different phrasing which omits the "or."

⁸ Rinaldo, Paul L., W4RI, "Is the Transmission of Digital Image Files Permissible Under Part 97 Rules?" sidebar, *QST*, February, 2004, p.

12. Rather than a wholesale revamping of the rules to provide for segmentation by bandwidth, I strongly urge the Commission to consider amending §97.3(c)(2) further along the lines that the Commission has proposed already in WT Docket 04-140 and accommodate the development of multi-media applications by expanding the definition of the data emission type to include emission types J2C and J2E with appropriate bandwidth limits.

III. Simplifying the Rules for RTTY and Data

13. The current rules for RTTY and data modes are too complicated, are too restrictive and have out-lived any usefulness they may have once had. I agree with the intent of the Petition to “eliminate, to the maximum extent possible, the specific protocols or modes of emissions from the rules.”¹⁰

14. I support a simplification of §97.309 along the lines of what is proposed in the Petition but in doing so I strongly urge the Commission to retain the language in the current §97.309 that restricts RTTY and data emission to “any technique whose technical characteristics have been documented publicly.” A requirement for public disclosure does not impose any substantial burden on development and greatly facilitate the ability of the Amateur service to monitor itself and self-regulate.

⁹ Present digital voice and digital image standards transmit at low symbol rates *e.g.*, 50 baud in the case of the AOR fast modem that is used for digital voice.

¹⁰ The Petition at paragraph 13.

IV. Narrowest Proposed Bandwidth

15. The ARRL states that the bandwidth of 200 Hz is intended “*to permit Morse telegraphy at all speeds that human operators can decode.*”¹¹ Using the formulas provided in § 2.202(g) of the Commission’s Rules, a necessary bandwidth of 200 Hz corresponds to a speed of 50 words per minute for a fading circuit (a fading circuit being the conservative and realistic assumption for over-the-air operations in the HF portion of the spectrum). Thus, it would appear that the ARRL would have the Commission believe that 50 words per minute is the limiting speed at which “human operators can decode Morse telegraphy.”

16. To illustrate inaccuracy of this claim I call the Commission’s attention to the IARU High Speed Telegraphy (HST) World Championships¹². In the portions of the competition simulating over-the-air usage, the competitors demonstrate their ability to decode of Morse telegraphy at speeds ranging from 80 words per minute and 125 words per minute. In non-competitive, practice session, competitors decode at speeds of 147 words per minute¹³.

17. As the HST competition has been reported to draw more than 150 participants from more than 15 countries¹⁴, there are obviously sufficient examples of human operators who are capable of decoding Morse telegraphy at speeds which

¹¹ The Petition at paragraph 18.

¹² Kutner, Barry, W2UP, “High Speed Telegraphy Competition in Macedonia”, *QST*, November, 2005, p. 56.

¹³ International RUFZ – Toplist < <http://www.sk3bg.se/CONTEST/rufztop.htm> >

¹⁴ ARRL Letter, Volume 16, Number 8 (February 21, 1997)

have necessary bandwidths in excess of 200 Hz. This calls into question the adequacy of this choice of bandwidth to fulfill its stated intent.

18. Under the proposed rule changes, the current §97.305(a) which provides that: “an amateur station may transmit a CW emission on any frequency authorized to the control operator” would be retained. The proposed rules would appear to add a new, “bright line” distinction that an amateur station may not transmit Morse telegraphy at a speed more than 50 wpm via CW emission in certain designated frequency bands.

19. As the designated bands are specifically the segments where by convention and band plan Morse telegraphy currently occurs, the retention of §97.305(a) in an unmodified form creates confusion as to whether it is the specific authorization in §97.305(a) or the bandwidth restrictions in the proposed §97.305(e) that governs CW emissions.

20. If the Commission deems that rules changes are the appropriate response to the Petition, I would urge the Commission to consider restating 97.305(a) as :

An amateur station may transmit an A1A emission, not subject to the bandwidth restrictions of section 97.305(e), on any frequency authorized to the control operator except for the frequencies in the 60 m band.

To provide clarification that authorization for use of CW telegraphy, and specifically CW telegraphy intended for *aural* reception and not *automatic* reception, at speeds of the operators choosing is retained.

V. Proposed Table is Too Complicated

21.If the Commission considers the segmentation of the Amateur bands by bandwidth rather than mode to be in the public interest, I suggest that the segmentation plan that is presented in the Petition is more complicated than necessary.

22.The “greater protection for narrowband emission modes”¹⁵ to which the Petition makes reference is illusory. The proposed rule changes create not only creates a new set of segment limits, they also create an incentive to develop new modes designed primarily to regain access to the spectrum in the new narrowband segments.

23.As an example, the selection of both a 200 Hz bandwidth and a 500 Hz bandwidth seems to makes too fine a distinction which may prove to be counterproductive. The 200 Hz segments will exclude standard RTTY sent at 45 baud using frequency-shift keying with a shift of 170 Hz shift¹⁶. It will not take long for spectrum hungry Amateurs to “tweak” the baud rate, the shift or both of their RTTY emissions to create a new “200 Hz” bandwidth compatible RTTY variant. Rather than fostering technical development, the proposed rule changes will encourage abandoning well established mode parameters to satisfy an arbitrary set of bandwidth limits.

¹⁵ The Petition at paragraph 13.

¹⁶ This emission has a necessary bandwidth of 249.5 Hz per §2.202(c)(1).

24. I suggest that the Commission consider eliminating the arbitrary distinction between “200 Hz modes” and “500 Hz modes” by amending the proposed table in §97.305(e) to delete the 200 Hz maximum bandwidth segments and substitute a single 500 Hz maximum bandwidth segment in each band from 160 m to 2 m.

VI. Inefficiencies of Band Planning by Rule

25. The proposed rule changes will negatively impact the ability of US amateur stations to successfully engage in international communications using the RTTY emissions to some extent on all HF bands but especially on the 80m and 40m bands.

26. The proposed dividing lines between the “200 Hz modes” and “500 Hz modes” are to some degree arbitrary, as any such portioning must be. And the results cannot be made to harmonize with all current international band plans and operating practices. As a consequence, the proposed changes do represent some loss of existing privileges and will force changes in current operating practices of US amateurs. Some examples:

- Amateur stations in Japan are limited by rule to operating RTTY in the 80 m band to 3520-3525 kHz.
- The IARU Region 3 band plan recommends RTTY operations at frequencies 7025-7040 kHz in the 40 m band, 5 kHz below what the proposed rules would allow for U.S. Amateurs.
- The IARU Region 3 band plan is silent on recommended frequencies for RTTY operations in the 80m band.

27. I suggest that the best way to provide the flexibility to accommodate such differences is to eliminate the arbitrary distinction between “200 Hz modes” and “500 Hz modes” by amending the proposed table in §97.305(e) to delete the 200 Hz

maximum bandwidth segments and substitute a single 500 Hz maximum bandwidth segment in each band from 160 m to 2 m.

VII. *De Facto* Phone Band Expansion

28. Despite the assertion in the Petition that the proposed changes are “not a means of expanding telephony subbands,”¹⁷ the effect of adopting the rules changes as proposed in the Petition will be exactly that.

29. Considering specifically the 14.100-14.150 MHz segment of the 20 m band, this segment is now used extensively for SSB by non-U.S. Amateurs, something the Petition concedes¹⁸. This makes access to telephony in this segment *extremely* desirable to U.S. Amateurs. We must anticipate substantial difficulty in obtaining voluntary compliance with any band plan that does not treat U.S. Amateurs on an equal basis with their international colleagues. As the IARU regional band plans for Region 1, 2 & 3 each permit phone emissions in the 14.101-14.150 MHz segment, one must expect that is where U.S. Amateurs will want to operate phone as well.

30. The 14.100-14.150 MHz segment which is available to General, Advanced and Extra class licensees is immediately adjacent to the 14.150-14.175 MHz segment which is available by rule only to Amateur Extra class licensees. Having one segment of spectrum, access to which is regulated by rule, immediately adjacent to an equally or more desirable segment of spectrum, access to which is regulated only by a voluntary band plan, is not a design for successful self-regulation.

¹⁷ Petition at footnote 12.

¹⁸ Petition at paragraph 19.

31. Turning now to the 7.100-7.150 MHz segment which was not highlighted in the Petition. Changes resulting from WRC-03 have created great interest in access to telephony in this segment amongst U.S. Amateurs. Here again, the current IARU band plans for Regions 1, 2 & 3 all permit phone operations within this segment. One must anticipate substantial non-adherence with a U.S. band plan that unilaterally restricted the access of U.S. Amateurs to modes or frequencies available to non-U.S. Amateurs under the IARU Regional band plans.

32. Phone band expansion may be an appropriate change to consider at this time. *Nevertheless, phone band expansion is a change that should be given due consideration as one of the likely consequences of the proposed rule changes and not simply dismissed in a footnote.*